HELLENIC ELECTRICITY DISTRIBUTION NETWORK OPERATOR S.A.

NOTICE OF CALL FOR TENDERS No ND-207

PROJECT: "Pilot Telemetering and Management System for the Electric Power Supply Demand by Residential and Small Commercial Consumers and Implementation of Smart Grids"

TECHNICAL DESCRIPTION OF CENTRAL SYSTEM

TECHNICAL DESCRIPTION OF THE SYSTEM

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1. General description of the System

1.1. General information

1.1.1. Scope and main characteristics of the system

The tender notice relates to the implementation of an Advanced Metering Infrastructure (AMI) and Meter Data Management (MDM) system for meters of small enterprises and residential users.

The system shall be suitable for the acquisition of energy consumption and production readings in order to process them and make them available to the legally responsible bodies of the energy market. The system shall also provide data relating to its performance, including, but not limited to, communication links quality, meter status, quality data, as well as interacting with the meter and the in home display.

The system shall include the installation of all hardware and software equipment required for its operation in order to meet the requirements specified in the tender notice issues.

1.1.2. Software (s/w) language

1. The user interface of all offered software shall be in the Greek language.
2. All reports and all system output data shall be in the Greek language.
3. The help file and the accompanying manuals shall be in Greek language.
4. The technical manuals shall be in the Greek language.
5. By exception, and with the consent of the supervising department, the manuals related to specific system software used for auxiliary operations (e.g. antivirus systems, etc.) may be in the English language.
6. Training and all manuals related to the main daily workflow shall be in the Greek language.

1.1.3. General Requirements

7. The system shall be based on standard software (which shall have already been developed and shall have been in commercial use in similar installations).
8. The operating system shall be up-to-date and preferably in the most recent version, and suitable for applications of this size. Databases shall be up-to-date and relational.
9. The computer applications and the AMI and MDM systems software shall be of the latest version as developed by the manufacturer using a modern software development environment and programming language.

10. During the whole project, software, including operating systems and databases, etc., must be upgraded in their latest version.
11. All software required for system operation, including software maintenance fees as well as software licenses, shall be included in the technical and financial offer (e.g. operating system, server licenses, database licenses, user licences).
12. Software licenses shall be valid for the whole project period.
13. The data processing system shall ensure two-way data exchange with other HEDNO systems, as described in the "Technical Description of the Project" tender issue.
14. The data exchange system shall be flexible enough to enable easy adaptation to future requirements.
15. The use of a MDM "mirror" database, which is updated in real time, shall be provided to ensure that the primary MDM database is not impacted. This additional database must be updated/ synchronized at least once per minute from the primary MDM database, in order to be used by other authorized systems.

1.1.4. Main structure of the system

16. The system shall comprise separate modules to ensure the functionality and independence of its functions.

Separate modules are required for the following functions:

- Communication with the meters
  - Remote disconnection/reconnection
  - Change of tariff zones
  - Demand management functions
  - Load Limiting Functions
  - Meter firmware update
  - Meter configuration
- Data collection
  - Registers
  - Energy curves
  - Log file, Meter State of Health (SOH)
- Data management
  - Record and maintain relationship of customer - meter
  - Record and maintain relationship of meter to distribution substation
  - Record and maintain spatial location of meters
  - Data validation, editing, and estimation (VEE)
  - Asset management
  - Data availability to authorized -by the law- bodies
- System use
  - Provide user access for all system functions
  - Virtual Private Network (VPN) communication
  - Provide remote user access for all system functions
- Synchronization of the system time

- Messaging to In-Home Display (IHD)
- Communication with mobile devices via SMS, WEB or Smartphone applications
- Operation
    - Service level agreement (SLA) metrics
    - Communication network performance metrics
    - System monitoring and troubleshooting
    - Communication network monitoring and troubleshooting
    - Activity scheduling, monitoring and troubleshooting
    - Requests management
    - Firmware upgrade management and verification
    - Alarm, flag, and event analysis
- Deviation Detection
    - Analysis of measures of consumption kW, kVAr and voltage
    - Comparison of aggregated meters to distribution transformer measurements (balancing)

The aforementioned list cites indicatively only the main modules of the system.

17. The number of modules required for full System operation shall be defined in the contractor's offer.

18. Both the Main System and the Backup System shall at minimum include six (6) operator workstations and two (2) system Administrator workstations.

19. The communication connection of the Main and the Backup System shall be provided by the Contractor, after previously determining the requirements (communication speed, bandwidth, etc.)

1.2. Central AMI/MDM systems operation

AMI (Automated Meter Infrastructure) system's main operation is to control and manage the meters through two-way communication, collect data from the metering points, and upgrade meters with new software and multi-zone tariffs.

20. The system shall acquire data automatically, with no supervision, from all meters according to the technical specifications and the respective schedules.

The MDM (Meter Data Management) system shall process all data to and from the AMI and permit all necessary operations on them, such as data exchange with other systems, internal operations such as aggregate processing, data reliability check, validation, verification, replacement of possibly missing data, and reports generation.

21. The AMI/MDM systems user licenses and associated maintenance fees, for each workstation, as well as any additional remote (Internet) licenses, should be included in the offer and should be valid without further renewal for the whole period of the project.

1.3. Normal operation

22. Guided by specific programmed schedules, the data collecting system shall perform data collection from all meters via preset communication channels. Data resulting from this function shall be stored in the main and backup AMI/MDM system databases as well as the MDM mirror databases.

23. The application shall automatically check the integrity of acquired data. Missing register and/or interval data will trigger follow-up reads at scheduled intervals until a timeout has been reached at which point the system will store the missing data as null values with a corresponding status designation of "missing". Timeout should be measured in days to ensure the data stored in the meter has been retrieved. In the event data is not retrieved, the timeout has been exceeded and newer data also fails to be retrieved the meter shall be included on a daily report that lists non-responsive meters.

24. The AMI/MDM system shall check, validate, and verify the data and shall automatically prepare all necessary reports on a periodic basis, according to its configuration.

25. For any data that was not collected, was lost, or has errors, and for which the follow-up read process has failed, an automatic estimation procedure shall be in place, which shall be able to insert data calculated using specific algorithms; such algorithms shall be thoroughly documented and agreed upon with HEDNO.

26. Offferers shall describe in their Tender response all Validation, Editing, and Estimation (VEE) processes.

27. Authorized users shall be capable of editing the data, with their intervention being recorded according to procedures proposed by Contractor and approved by HEDNO.

28. It shall be possible for utility users to access the data, depending on the access (security) level of the user group to which they belong. This shall enable users to create all types of reports or perform actions in accordance with their access level, and depending on the limitations imposed on them (geographical, administrative, etc.).

29. It shall be possible to either print the results of data processing in the form of reports or to make them available to other information systems.

30. In the event that remote collection of meter data is not possible, a procedure for field collection shall be documented. This procedure must be automatically started so that data will be available to the bodies in time. The Contractor shall be responsible for the execution of the field collection procedure.

31. Data export shall be performed in files with predefined format (e.g. ASCII, XML, CSV, etc.), through the use of web services and/or APIs. The format of the data files shall be such, that the data will be

available to other systems.

1.4. System capabilities

1.4.1. Meter data reading capabilities

32. The system shall be able to read data from and process at least 300,000 meters once per day.
33. Such data is read from the meters and shall include all 15 minutes interval data (15' load profiles) as well as readings from registers, tariff data, events and energy quality data.
34. The period required for reading all such data from all the meters should be less than 8 hours (00:01 - 8:00).

1.4.2. Data sending capabilities to the meter/in home display

35. The system shall be able to transfer new software data to the meter (firmware updates), and new tariff zones data, as well as to control meter functions (connection/ disconnection, etc.). Communication with the meters shall be possible either to individual meters or groups of meters as assigned in the AMI/ MDM.
36. A meter shall be permitted to be included in more than one group.
37. Dynamic group creation for ad-hoc reporting, configuration of reports etc. shall be supported.
38. The meter shall be capable of command prioritization such that multiple pending actions do not prevent the meter from collecting data or communicating with the AMI/MDM system.
39. The data transmission speed shall be adequate to transfer data to all meters from the central system within less than 8 hours.
40. Direct commands to a single meter must be executed in near real time.
41. Connection / disconnection and load limit commands to the meters shall be managed by the system.

1.4.3. Data processing capabilities

42. The offered system shall process all load profiles (intervals) and registers from all metering points. The system shall be able to read, aggregate, compute, check, verify, replace and distribute data from 300,000 metering points.

1.4.4. System access and setting of operating parameters.

43. The system shall be operated by users with different levels of "access" to its functionalities.
44. The system administrators shall be responsible for defining user "access" levels and for creating different user groups by assigning specific operational capabilities to each group.
45. It shall be possible to group the users and to provide group-level access to metering points determined by certain characteristics thereof, such as their geographic location, HEDNO administration division, energy supplier, type of meter point, etc.
46. A meter shall be permitted to be included in more than one group.
47. Dynamic group creation for ad-hoc reporting, reports configuration etc. shall be supported.
48. There shall be no restrictions on the ability to group assets and name such assets.
49. Users should be identified by the system via a user name and a password.
50. Administrators set the permissions and access for each user.
51. Depending on the administrator-assigned capabilities (roles), the users shall be able to set the system operation parameters according to their permission level.

1.4.5. Data access

52. Access to data stored in the system shall depend on users' "access" rights.
53. The data as collected by the system at any point in time shall be stored without modification.
54. Users shall not be allowed to modify raw collected data.
55. All edits, modifications and configurations are stored separately as alterations of original data.
56. MDM data, shall be available only through a run-time copy of the MDM database (MDM "mirror"), so that third parties have read-only access to them.
57. All MDM data shall be stored and made available to the legally responsible bodies.

1.5. Requisite functions

The functionality, as provided for by the tender notice, shall be implemented in the system as follows:

1.5.1. Support of metering equipment

58. The list of low voltage customers' data which is required for the creation of customer records and integration into MDM systems, will be available by HEDNO.

1.5.2. Software for remote data acquisition

59. The AMI application shall include all functionality required for remote reading of meter data.

60. Secure communication between metering points and the central system shall be ensured, as described in the "Security Requirements for the Project" tender issue.

61. Time Adjustment of meters and initialization of billing periods for the meters shall be performed in batch mode and it shall be possible to fully automate, monitor and integrate them for all metering points or for selected number of metering points.

1.5.3. Software for on-site data acquisition and meter parameterization

62. The Contractor shall provide all hand-held portable devices, as well as software for those hand-held portable devices for locally communicating and/or programming or/and data retrieval through the meter optical port.

63. The telemetering system shall be updated with data received from all meters right after their installation.

64. Upon installation of the meter, the system shall automatically detect and provision the new meter with pre-determined parameters.

65. Furthermore, software shall be provided for on site acquisition of metering data and their transmission to the central system.

66. For each installed meter, the meter location (GPS coordinates) should be recorded, as well as the possibility to store the connected LV transformer, the substation LV feeder, a photo, etc.

1.5.4. Software for additional capabilities

67. A feature of the system should be the ability to provide processing support for energy management (Energy Data Management -- EDM) and quality of power supply, such as calculations for aggregate load curves of meters for one or more areas, identifying areas with poor voltage quality etc.

68. It shall also be possible to create "virtual metering points" in order to calculate the total energy generated/consumed per supplier/producer.

69. For this purpose, each metering point shall be characterized based on the energy supplier or producer, or even based on the representation percentages, so that said calculations shall be performed automatically without user intervention. Given that these settings could change at any time, the software used shall be able to recognize/ support such changes, while maintaining detailed data history.

70. It should be possible for such virtual metering points to be defined in the system, and their load profiles shall be available at any time, in the same manner as the data from the actual metering points of the network.

71. At least, such virtual metering points be defined, in order to provide load data from grouped metering points, for the following:

- All Administrative Regions of HEDNO
- All Administrative Prefectures of HEDNO
- All energy suppliers-producers, grouped by HEDNO Region and/or Prefecture.
- Virtual metering points that represent the aggregated consumption of end users that are associated with a specific MV/LV transformer.

72. It is important to ensure that adequate processing power and memory shall be available at any time, in order to perform all these operations smoothly and without delay to any system function.

73. A virtual meter shall be able to be defined by any combination of meters or groups at any level.

1.5.5. Data export

74. The system will export, in an appropriate form (e.g. CSV) meter registers data, load profiles, applications usage data (Consumer Web Portal, Mobile Platform, etc) as well as more system data. HEDNO will specify respectively the format requirements for the above-mentioned files.

1.5.6. Software for analysis, statistical purposes, and reports.

75. It shall be possible to analyze and compare each load curve against historical data for each metering point, real or virtual, or against other existing statistical data for the said metering point.

76. The software shall be able to perform analytical processing and it shall contain algorithms for data validation via comparisons with specific models, verification meters, MV/LV substation meters (for balancing) or/and comparison with historical data used for detecting e.g. possible energy theft.

1.5.7. Data exchange between parties involved in electricity market

77. The system shall enable the exchange of data with other entities or Services (e.g. RAE, IPTO, Operator of Electricity Market, Ministries, etc.).

78. A typical data transfer mechanism shall be via e-mails or using APIs, etc.

79. Such interfacing must not result in a measurable impact on the system performance.

80. The Contractor shall provide a mechanism (e-mail server) enabling the user to create email messages that will be sent automatically by the system in case of certain situations (events).

2. Specific requirements for the AMI/MDM system

2.1. General Description

81. The AMI/MDM systems shall be two separate applications from the same or different manufacturers that will cooperate, as a single system.

82. AMI and MDM Systems must be able to be separated and operated in different physical locations.

83. Systems must operate using modern operating system both for the central system servers and for the user workstations.

84. The data shall be available online to the users for a period of five (5) years at least. For history data collected prior to five (5) and up to twenty (20) years ago, permanent automatic archival shall be provided within a suitable storage medium, as well as the procedure of data retrieval when required.

85. The network architecture and user access via terminal stations shall be based on modern established standards.

The architecture shall be fully scalable, enabling:

- To add additional workstations in the system.
- To add additional users to the system.
- To add additional devices for communication with the meters.
- To integrate third-party services such as advanced analytic functions, consumer-centric applications, and other business processes.

86. Both at the operating system level and application level, user's critical actions (e.g. information deleting) shall be confirmed prior to execution.

87. Moreover, the offered system shall support a flexible data model

with versioned data and full control capabilities in order to ensure data protection.

88. The application shall have a modern graphical user interface (GUI). This interface shall follow the operational logic of the Microsoft Windows operating system interface, which is familiar to most users, in order to facilitate users training.

89. Application must allow the user to schedule automatic data acquisition or follow-up acquisitions at predetermined times and intervals and through predefined communication channels, as well as automatic data management and export.

2.2. System components (modules)

90. The basic functional entities of the system shall operate in separate operational units. As a result, separate servers shall be provided (indicatively and not limited) for:
    - Communication with meters and in home displays.
    - Communication with concentrators.
    - Relational database management.
    - Web Applications.
    - Application servers.

91. The system shall operate harmoniously as a whole and any upgrades thereof shall not disrupt its overall smooth operation.

2.3. System Operation

2.3.1. Customers - producers management

92. The system shall have a database that includes customers - power producers.

93. Any customer or producer may have one or/and more meters.

94. Historical data from older meters that have been replaced must be transferred and kept to the new MDM.

95. The system shall have a process to ensure that when a meter is replaced, historical data are kept associated with the customer/producer.

96. The import – update of customer and producer data shall be carried out automatically, by importing such data from other HEDNO information systems. It shall be possible to selectively perform such updates for individual fields and/or individual customers or producers.

97. The system shall group metering points according to various user-selected features.

2.3.2. Management of metering points

98. The system shall have a database including all metering points.

99. Indicative but not limited data to be stored and managed in relation with metering points are:

- Customer number (ID) or unique number of metering point
- Meter number
- Telecommunication connection details (e.g. telephone number, IP address, GSM/GPRS signal power)
- Installation date
- Customer name, address, contact, pictures, geographical coordinates of meter
- Transformation ratios
- Contracted power
- Meter seals
- Metering point status (active, disconnected, etc.)
- Substation and LV feeder
- Suppliers and representation percentages
- Customer history

100. A history of every data modification shall be preserved.

101. The metering point presentation (as well as the customer-producer presentation) shall be displayed in tree format, which shall be created automatically according to the characteristics of each metering point. Therefore, the user shall not be required to maintain the tree, but the tree shall be automatically updated following the meter point features modifications.

102. The user shall be able to select the type of the displayed tree structure, and several preset types shall be provided, such as:

- First level: Administrative division (Region, e.g. DAA)
- Second level: A more detailed administrative division (Area, e.g. Xanthi area)
- Third level: Supplier (e.g. PPC)
- Fourth level: Billing period end day (e.g. 15th day of the month)

Indicatively, some of the metering point features that can be used to define levels are:

- Geographical location,
- Administrative division,
- Supplier,
- Type of supply,
- Energy Use type

A second tree view will provide a network view, such as:

- First level: HV/MV Substation, MV feeder
- Second level: MV/LV substation
- Third level: LV feeder
- etc.

The aforementioned elements must be determined in detail in the system

design and be implemented in a way providing the necessary flexibility to enable their modification if other requirements arise in the future.

2.3.3. Data collection - Communication - Management of telecommunications equipment

103. The system shall perform meter reading operations.

104. A main feature of the system shall be its ability to support different types of meters. It shall be possible to integrate new meters in the system by installing their respective drivers. The system shall confirm the proper driver installation and produce the corresponding report.

105. The collection of meter data is possible to be effected through acquisition from other systems, using the respective manufacturer's software, and then to automatically import said data into the MDM system.

In particular, the pilot system MDM shall communicate with the existing AMR/MDM system of major LV customers (power supplies through Current Transformers) of type ZFA-F by ITF-EDV Fröschl. The scope of this particular communication is the energy balancing between different virtual metering points. Message exchange must be done at least once every 24 hours.

106. It shall be also possible to automatically import data acquired on-site from the meters using portable devices (e.g. handheld, laptops, netbooks).

107. The acquisition and transmission of data to the central system shall be made automatically from the above-mentioned portable devices.

2.3.4. Metering data and load curves data management

108. All metering data shall be validated before being processed by the system.

109. All data shall be certified by the system, as provided for by the applicable standards and the current legal framework.

110. To this effect, suitable verifications shall be performed in order to:

- Verify data identity
- Ensure data completeness
- Schedule follow-up data collection if required
- Fill gaps in data if needed
- Check data reliability/quality

111. The system shall be able to process all data that may be provided by the metering points, such as:

- Energy data
- Tariff data

- Load curve data
- Calendar data
- Energy quality data
- Event data (alarms, log files)
- Meter status data etc.
- Historical data
- Command acknowledgement
- Command result

112. The system shall be able to issue remote commands to the meters for basic operations, such as clock synchronization, connection/ disconnection, load limitation/upgrade, termination of billing period, etc.

113. The system shall be able to process the certified data and to perform user-defined calculations.

114. The system shall be able to perform complete statistical processing of the energy quality data and provide results in the form required by each involved entity and by the law, either for individual customers or for customer groups.

115. The data of the metering points shall be analyzed in different tariff zones and to this effect the system shall be able to process the load curves.

116. The system shall plot load curve graphs using different colors for the various tariff zones. The graphs shall be able to provide details for the energy or power, and it shall be possible to perform different types of analyses per different periods of time.

117. The system shall support export of processed metering data and shall include the necessary functions for the delivery of such data.

It shall be able to:

- Group the data to be sent, depending on the recipients.
- Dispose them to the recipients according to a specific data formation.
- Choose the data transmission method.

2.3.5. Task scheduling - Process automation

The system shall be fully autonomous, such that no user interaction is required except for problems with respective logging.

118. The data shall be acquired from the metering points between 00:01 and 08:00.

119. Any follow-up attempts to acquire metering data again due to previous failures shall be automatically programmed and executed. For all meters that did not eventually communicate with the remote reading center, failure reports shall be automatically created (e.g. low signal level); such reports shall be automatically sent to the

department responsible for restoring the failure (e.g. Telecommunications Provider, HEDNO Area or Region). A failure report/failures list will also trigger further activities.

120. The billing data and/or load curves shall be automatically exported in the appropriate format and shall be automatically made available to the responsible entities in the specified format and via the specified medium.

121. The system shall automatically detect any problems in the metering equipment (e.g. meter malfunction, alarms/events) and shall generate reports in predefined format for predefined recipients.

122. During automatic execution of the system functions, if deemed as necessary, a user control and intervention stage shall be included e.g. in order to avoid the delivery of a communication failure report if it is already known that specific telecommunications provider or distribution network problems occur in a given area.

123. The system shall also be able to remote control (open/close) the meter relay output for purposes of load management in specific consumer circuits or for tariff zone indication, etc.

124. It shall also manage the incoming event alarms, such as meter tampering etc. and issue reports to predefined recipients.

2.3.6. System Users Management

125. System users shall be able to access the system via terminals connected with the servers through a LAN.

126. It shall be possible to access the system remotely via VPN (Virtual Private Network).

127. User access to the system shall be also provided via the Web application.

128. Each user will have access rights depending on the group to which he/she belongs.

129. The system administrator shall define the access rights for each group and/or user. These limits define both the scope of access to the system data (which system elements shall be visible to the user) and the user's operational capabilities (which elements can be added, modified, deleted, executed by the user).

2.4. WEB Application

The WEB application permits access to HEDNO staff as well as third parties/entities authorized by law.

130. The WEB application shall provide data access via the Internet or Intranet, through appropriate equipment.

131. For external authorized users a suitable security system for access

through the Internet shall be provided.

132. A special application shall be provided for authorized third parties/entities enabling them to access energy quality data.

133. Indicatively, it is mentioned that this application shall include the SAIDI, SAIFI indices per metering point, geographical area, or any defined grouping of meters, etc.

134. The level of access of each authorized user to his data may be modified in batch mode depending on the user group to which the authorized user belongs.

135. The WEB application will be installed in a different server for security reasons and shall provide authorized user access based on login and password credentials.

136. Depending on the access levels provided to authorized users, they shall be able to:

- Monitor register data
- Display in plots the load curves and the supply quality data
- Receive data in a standard format

137. The system shall be capable of sending messages, defined by HEDNO, to the users of Consumer Web Portal and mobile Platform as well as to the In Home Displays.

138. A special application shall be provided for management of Internet users; this application shall enable the user to change his personal password, and to be notified via email with instructions about password recovery.

139. The Contractor shall ensure that the equipment has adequate computing power and bandwidth in order to serve the simultaneous access of a large number of users in the utility Web application.

2.5. In-Home Display

140. The system must communicate with the installed in-home displays and send messages to them.

141. The meter shall only accept IHDs which are known and trusted. This requires a pre-registration of in-home devices (unique identifier) and enablement of such devices on the AMI/MDM network. These processes shall be fully described by the offerer.

142. The meter and the in-home display shall be uniquely paired such that there is a match between the device and the meter.

2.6. Test environment (testbed)

AMI/MDM systems shall operate uninterruptedly in order to meet their objectives. At the same time their operation shall constantly be improved by the means of the required system upgrades.

For this purpose, it shall be possible to perform tests, either for installing new software versions or modifying the configuration of each version in order to optimize performance. It shall also be possible to include - evaluate new applications.

143. For the AMI/MDM systems, a separate testbed system should exist without affecting their productive operation.

2.7. System security

AMI/MDM systems security requirements are described in detail in the "Security Requirements for the Project" issue.

144. The AMI/MDM systems shall be equipped with all necessary protection systems against:
    - Physical threats (fire, high temperature, over voltage, power failure).
    - Unauthorized access.
    - Malicious actions of Internet users.
    - Erroneous actions of its users.

145. For the aforementioned reasons, the system must be equipped with all modern security systems, such as: Air-conditioning, UPS, Firewall, Backup, antivirus, fire detection and fire protection, access control, monitoring of Center's operating conditions (supply voltage, temperature, humidity, etc.) and administrator notification (by SMS, e-mail etc.) in case of problems.

146. The system shall also ensure that its data remains consistent in cases of human error (ability to retrieve data in case of operations errors - deletions).

147. The Contractor shall ensure the whole system compliance with respect to the protection of customers' personal data.

3. Backup system

148. Since the system is considered critical for the operation of HEDNO, a backup system shall be in place in case of emergency.

149. Therefore, a backup system shall be provided; this system shall be installed in a different building from the main system, and shall be ready to operate as main system if required.

150. To this end, the two systems are required to communicate, in order for the backup system to remain updated and able to operationally replace the main system in case of emergency.

151. An automated replacement scenario shall be in place and shall be ready to be implemented when necessary.

152. The backup system shall have all the capabilities of the main system and shall be able to operate completely as main system within 1 hour following the decision of the authorized administrator for its transition into main system.

153. At the end of the event that required the backup system to operate as main system, an automated process shall exist to restore the main system for normal operation following its update from the backup system with all data stored in the latter.

154. The backup system shall return to its normal operation as backup system. The transition to normal operation for both systems shall be performed with the least possible interruption in their operation and in any case within less than 1 hour.